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Scoping Study Using Randomized Controlled Trials to Optimize Small Buildings' and Small Portfolios' (SBSP) Energy Efficiency Programs

Decision and Information Sciences Division

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Nomenclature

AEP	American Electric Power
BBEE	Behavior-based energy efficiency program
BGE	Baltimore Gas & Electric
BPA	Bonneville Power Administration
ComEd	Commonwealth Edison
DOE	U.S. Department of Energy
GHG	Greenhouse gas
HER	Home Energy Report
PG&E	Pacific Gas & Electric
PSE	Puget Sound Energy
PUD	Public Utility District
RCT	Randomized controlled trial
RED	RCT with encouragement design
SBSP	Small Buildings and Small Portfolios
SEE Action	State and Local Energy Efficiency Action Network
SMUD	Sacramento Municipal Utility District
WMECO	Western Massachusetts Electric Company

Executive Summary

This report is an initial step in determining whether randomized controlled trials (RCTs) should be used by the U.S. Department of Energy (DOE), utilities, and others to optimize energy efficiency programs targeting the small buildings and small portfolios (SBSPs) community. This scoping study reviews the use of RCTs to evaluate consumer purchasing and decision-making behaviors and to inform energy-efficient decision making. The scoping study discusses the relevant work, gaps in existing work, and potential value in pursuing further RCTs as related to energy-efficiency decision making in the SBSPs community.

Our findings show that the factors that drive consumer behavior toward the purchasing of green products or energy efficiency programs remain complex, requiring further study of the underlying behavior mechanisms leading to environmental concern and action. Although small- and medium-sized businesses may share some purchasing behaviors with individual consumers and large commercial portfolios, important differences should be considered. Factors that are relevant to businesses include firm size to determine economies of scale, regulation, age, and turnover of capital equipment. Marketing approaches to promote green services such as energy efficiency need to go beyond a conventional cost-benefit analysis to include the highlighting of the psychological benefits and delivery of practical benefits, such as energy efficiency.

Because of the uncertainty that is inherent in behavior-based marketing approaches, RCTs have been used to evaluate strategies when theoretical and methodological approaches have fallen short of helping us to understand behavioral change. Whereas RCTs have been widely used by medical and psychological communities to form clinical trials, their use in evaluating marketing strategies in other industries has been more limited in the United States and abroad. Marketing programs outside of the medical community have used RCTs for varied purposes such as to encourage tractor retrofitting in the United States; promote policies that encourage the purchase of health insurance in Senegal; and evaluate lender pricing, marketing, and risk strategies in South Africa.

In the energy sector, a recent surge of interest among utilities and energy firms to initiate behavior-based energy efficiency (BBEE) programs for residential consumers has created more interest in using RCTs. However, most of these programs have targeted residential consumers, and only a limited number of firms have expanded their programs to invite the participation of commercial customers. The successes that various firms have experienced in using RCTs to evaluate energy savings in several types of energy efficiency programs on the residential side suggests that energy savings gains could be achieved within the SBSP community.

We reviewed several approaches to residential BBEE programs and the structures of the RCTs that are used to evaluate energy savings. Our findings include the following:

- Benefits to using RCTs to evaluate residential energy efficiency programs include eliminating selection bias, limiting the influence of pre-existing differences among households, and eliminating selection bias from free riders.

- Broad acceptance of using RCTs to evaluate BBEE programs for residential utility customers supports the use of RCTs when BBEE programs expand to commercial customers and the SBSP community.

- Several types of RCTs were used successfully to evaluate residential energy efficiency programs and they could be adjusted to promote successful energy efficiency programs for the SBSP community.

- Review of residential BBEE programs reveal tangible energy savings ranging from 2% to as much as 10% per participant, as well as growing success in a broadening range of programs from home-energy reports to Web-based options.

- Efforts to expand energy efficiency programs outside of residential households have been very limited. Initial success on the commercial side includes a promising test case sponsored by Stanford University at a high school and at the Snohomish Public Utility District's (PUD's) Energy Challenge.

Success with residential BBEE programs and the use of RCTs, along with initial success on limited commercial programs, suggests that lessons learned from residential programs could be applied to developing effective programs for the SBSP community.

To accomplish this objective, we recommend that DOE consider the following as potential goals and high-priority areas of focus:

- Conduct further study to determine the potential for RCT pilot projects to guide DOE, utilities, and stakeholders in designing effective energy efficiency programs for the SBSP community.

- Evaluate new factors and constraints impacting decision making for commercial customers that could warrant changes to the structure of BBEE programs and the use of RCT evaluation tools.

- Design and conduct an RCT pilot project to evaluate the effectiveness of a prototype commercial-based energy efficiency program.

- Use results and lessons learned from RCT tests to create a template or tool to facilitate the development of BBEE programs for commercial customers and the SBSP community.

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1 Introduction

The process of characterizing the purchasing behaviors of consumers of green products — according either to demographics such as age, sex, or income or to psychographics such as altruism or environmental concern — has not been well established in the behavioral and marketing literature [1-7]. Although socio-demographic and psychographic variables are typically very easy to assess, differences between consumer attitudes and actual behaviors in purchasing environmentally innovative products mean that the predictive power of such variables is low [2]. The divergence between consumers' intentions to engage in purchasing behaviors (which can be predicted from consumer attitudes) and actual purchasing behavior is well known [4,8]. Recent studies have found that in some cases, the socio-demographic properties of consumers have more effect on purchasing behavior than the psychographic properties and vice versa [1]. These considerations impose significant hurdles in developing successful marketing strategies that aim to influence consumer purchasing behaviors.

Past marketing research has largely failed to determine the underlying mechanisms leading to tangible expressions of environmental concern (e.g., via purchasing behaviors), and some researchers have argued that relying on traditional marketing techniques that depend on using information about one purchase to predict another will not work for green consumers [3,5]. The complexities in characterizing green consumer market segments arise from multiple factors, including time-varying attitudes of environmental awareness and a decreasing willingness to pay premium prices on green products [9]. Consumers who purchase green products may show similar purchasing behaviors across product sectors, or they may limit their ecologically conscious purchasing to only a single sector on the basis of the industrial, political, and social structures of the sector [3,5,9].

Among the qualities that attract consumers to environmentally friendly products — greenness — or impact on the environment ranks very high, but other factors such as price, quality, and performance tend to weigh in as equally important [7,10]. In other words, the ecological impact of a green product does not solely impact purchasing behavior. Attracting and retaining consumer interest in green products requires that the products perform at least as well as conventional products, since consumers will not sacrifice performance and quality for ecologically beneficial product qualities [9,11,12]. In addition to the purchasing costs of green products and services, other costs exist in the form of information costs (searching), use costs, and disposal costs, all of which need to be balanced when compared to traditional products and services [9].

While marketers of green products can highlight the environmental benefits of their products and services, the ultimate determination of product value and quality is made by the customer [11]. Traditional definitions of product quality are considered typically from the point of view of the consumer, and not as an attribute definable by the manufacturer [13]. Modern models of product quality and value are multidimensional and complex, and they incorporate such variables as performance, reliability, durability, serviceability, aesthetics, features, perceived quality, and conformance to standards [14]. Other approaches to modeling consumer product values consider only those properties that have been shown to be most influential, including functional value (practical or technical benefits), emotional value (positive feelings play an important role in

future decision making), and social value (consumers feel they are connected to others by using a product) [11,15]. Considering the product's value and quality together, the adoption of innovative green products and services is as much a factor of product performance and price as it is a factor of how consumers consider innovation as it reflects on their identity, image, values, and norms [16]. When green products provide high consumer value, the price sensitivity of consumers of that product is typically lowered, with the result that consumers are more willing to pay a premium price for that product as compared to traditional alternatives [11].

1.1 Businesses as Consumers

The behaviors of small and medium-sized (and, to some extent, large) businesses share qualities with individual consumer purchasing behaviors; yet there are important differences to consider. In the cases of owners of small and medium-sized businesses, the same characteristics of individual consumer purchasing apply to the individual owners in addition to some characteristics of purchasing behavior that are reflective of commercial firms. As with individual consumers, not every firm in a particular sector will attribute the same potential for customer benefit to a given environmental issue [17]. In addition, firm size is an important factor that significantly influences environmental innovation [17]. Larger firms tend to adopt innovative environmental products and technologies more readily than do smaller firms, partially because of the economies of scale.

Studies have shown that although external institutional forces such as regulation play major roles in encouraging certain firms to adopt green initiatives voluntarily, firms that have developed superior environmental initiatives appear to be more dependent on economic or altruistic reasons for pursuing voluntary green initiatives than do less successful firms [18,19]. Furthermore, suggesting to firms that they should simply incorporate greener technologies fails to consider such factors as age, condition, and turnover and depreciation of capital equipment and how it is distributed in an industry [3].

1.2 Challenges and Approaches to Marketing Consumer Innovation

Clearly, marketing approaches to green consumers advocating that they adopt environmentally friendly and/or energy efficient products need to address the unique challenges across multiple sectors; nevertheless, this reality has not been well studied from the perspective of the consumer [11]. Conventional marketing theories assume that customers will attempt to maximize benefits while minimizing costs [9]. As has been demonstrated, however, consumers of green products will pay a premium price over conventional products as long as the product value is acceptable to the consumer [1,2,4,7,9,11]. Suppliers must differentiate green products from other competing green products, as well as from conventional products [7]. Marketing communication approaches may involve increasing value perception by clarifying the physical and psychological benefits of using green products, which can target how a given product delivers practical benefits by way of its pro-environmental attributes, such as energy efficiency [11]. Convincing customers of the satisfaction they will derive from their green purchase might be a key advertising objective [11].

In the context of consumer behavior and social norms, marketing communications should exploit social values in promoting green purchases [11]. Research has demonstrated that ecologically concerned consumers believe in the people's power to change adverse social conditions [2], and in some sectors, consumers may be more interested in the (green) product's image — and in how their use of the product reflects on them — than they are in the product itself [5]. While it is still important from the consumer's perspective to understand the real impact that their actions have on environmental preservation [1], manufacturers of green products must recognize that consumers will not pay for a benefit from which they will not exclusively and personally benefit [7]. Therefore, marketing strategies that are aimed at promoting the environmental benefits of a product or a service need to frame these benefits in a way that consumers can readily identify and understand.

Behavioral intervention campaigns that aim to change consumer purchasing behavior can be an effective strategy in convincing consumers to adopt innovative and environmentally beneficial technologies, products, and services. There has been an increased interest in non-price energy conservation programs that are informed by insights from behavioral science. Non-price interventions are typically inexpensive relative to rebate-based interventions [20]. Behavioral change models [21,22] can be exploited in defining effective intervention campaign strategies. These models segment individuals according to how likely they are to adopt innovative behaviors based on their expressed attitudes toward the innovation. Some individuals are pre-contemplators who have not spent much effort on examining the benefits of innovative products. Those individuals who have considered innovation (contemplators), but have not yet adopted the innovation, spend more time thinking about adopting than do pre-contemplators, and they are more receptive to information-based marketing strategies.

As with traditional marketing approaches, the incorporation of social and ecological aspects into marketing strategies depends not only on the industry sector, but also on the market segment in which the company competes [6]. Because of the uncertainty that is inherent in behavioral models of consumer purchasing, along with the difficulties in comparing purchasing behaviors across products and sectors, marketing campaigns must be evaluated in an experimental manner. A number of randomized experimental marketing studies have used the randomized controlled trial (RCT) to evaluate strategies when theoretical and methodological shortcomings have limited the researchers' understanding of which combinations of behavioral change strategies are optimal.

1.3 Randomized Controlled Trials

RCTs are a type of experimental study that has been used and refined by the medical and psychological communities in the last 100 years. RCTs are used as clinical trials whose purpose is to evaluate the patients' responses to medical treatment regimes. The key features that differentiate RCTs from other experimental methods are the randomization of the process of selecting participants (patients) into treatment and control groups, as well as the potential blinding of the trial participants and evaluators [23-27].

Randomization of patients involves their assignment to treatment, non-treatment (control), and placebo groups. The patients in the treatment receive a medical treatment being tested for efficacy; the patients in the control group may receive no treatment at all, or may receive a placebo medication. Placebo treatment is needed in cases when participant behavior is affected by being in the non-treatment group. In the context of clinical trials, patients can respond positively to placebo treatments in some cases, even though no active therapy is present. The placebo effect therefore needs to be differentiated from the therapy being tested in the trial through the use of placebo groups. A statistically significant result between the placebo and treatment groups is necessary to prove the efficacy of the treatment — in other words, to rule out the placebo effect.

Randomization prevents bias in assigning patients to treatment groups. Any significant differences between groups in the outcome event can be attributed to the intervention and not to some other unidentified factor. The purpose of the random allocation of participants is to assure that the characteristics of the participants are as likely as possible to be similar across groups at the start of the comparison. Single-blinding occurs when only the experimenters are aware of which participants are in the control and treatment groups. Participants in single-blind studies are not aware of what treatment they are receiving, nor do they have a choice of the group they are in since they have been randomly assigned to the study groups. Single-blinding eliminates the participants' behavioral bias in the study outcomes. Double-blind studies prevent the treating physicians, patients, and potentially even the analysts from knowing who received the treatment and who received a placebo. The combination of participant randomization and single or double blinding in RCTs provides the most precise type of experimental study design and is considered the gold standard in the scientific community. No other study design allows researchers to balance unknown prognostic factors at the baseline.

1.4 Application of RCTs to Marketing Research

RCTs for evaluating the impact of marketing strategies, especially for energy evaluations, are rare [20]. RCTs can solve the problem of establishing proper causality between policy and consumer behavior by randomly varying the business proposition to be evaluated and holding all other variables fixed. Other methods require strong assumptions about why people use a product to conclude that the product itself and not some unobserved characteristic of the individual or environmental influence caused a change in the outcome. Randomization eliminates these biases because individuals do not choose for themselves and because environmental influences should influence both the treatment and control groups [28]. This section will present some examples of RCTs that were effective in measuring marketing impacts on consumer behavior with various interventions.

An industrial farm equipment intervention RCT tested marketing strategies for influencing farmers' behaviors in favor of retrofitting tractors with safety devices to prevent injuries and fatalities from roll-over accidents [29]. This study included 400 farm owners in New York and Pennsylvania who were randomly assigned into three tractor retrofitting incentive groups, which were distributed across geographic regions. The first group included a financial rebate; the second group included the rebate and messages and promotion (social marketing); and the third

group received the rebate and limited communication. Messages were distributed as inserts in farm periodicals that were circulated only in regions that contained the social marketing groups. Surveys were conducted prior to and after the rebate and messaging campaigns; questions included opinions about retrofitting — attitudes, social influence, perceived ability to retrofit, and intentions to retrofit. The study outcomes included some interesting results, such as one finding that 20% of farmers would not retrofit even if the entire cost was rebated, which was speculated to be due to the farmers' underestimating their risk of serious accident. The combination of rebate and social marketing was most effective in increasing retrofit activity, and although messages addressed the perceptual barriers to retrofitting, costs remained the most influential barrier.

RCTs in the finance and insurance industries have also been conducted on a limited basis. In a study of 360 households in Senegal concerning the purchase/adoption of health insurance policies, researchers found that financial incentives significantly outweigh nonfinancial approaches in consumer purchase decisions [30]. Study participants were randomly assigned into three groups. The first group received only an invitation to an insurance seminar. The second group received — in addition to the same invitation as the first group — a voucher for the cost of the health insurance policy for one year. The third group received the same voucher as did the second group plus additional financial compensation. The second and third marketing treatments had large and positive significant impacts on purchase decisions; however, the first treatment of sending the invitation only had no impact on the purchase decision. A similar type of study in South Africa examined consumer behaviors for a financial institution and used 50,000 direct mailings to evaluate lender pricing, marketing, and risk strategies [28].

Within the public health sector, studies have been conducted that examine consumer response to marketing campaigns that are aimed at improving health, such as in an RCT of mosquito net adoption in Burkina Faso [31]. In this study, researchers used an RCT of community intervention on the effects of subsidized, insecticide-treated bed nets distribution through a social marketing system — with or without — free distribution. Two interventions were tested; one with social marketing and free distribution of nets and the other with only social marketing. There were 500 households per study arm: baseline surveys were conducted at the start, with a follow-up survey at 12 months. The study found that ownership of bed nets increased significantly over the study period and that ownership increased more with the first intervention.

1.5 Report Organization

In the next section, the role of randomized controlled trials in energy efficiency programs for small businesses are reviewed in terms of their relevancy for optimizing energy efficiency programs, including definitions/terminology, cost effectiveness and resources requirements. Next, the use of RCTs and similar approaches in energy programs are reviewed. Examples in which RCTs or similar approaches have been used to assess efficiency programs are identified, along with key stakeholders (e.g., specific utilities, owners and operators, organizations), existing resources (e.g., decision tools, databases, guides, etc.), and outreach and communications opportunities (e.g., industry events, utility bills, etc.) based on interviews with experts and reviews of journals, databases, reference lists, and conference proceedings. A

summary of RCTs and identified gaps with respect to use in energy efficiency programs is provided in the form of tabulated data for study authors, with the year published, study location, objectives, intervention type, duration, population, methodology, and outcomes. Finally, recommendations for further development of SBSP RCT pilot projects are provided.

2 Role of Randomized Controlled Trials in Energy Efficiency Programs

While waste management, healthcare, and transportation industries have been applying behavior-based approaches for several years, utilities and other energy firms are now adopting behavior-based programs to encourage residential customers to opt for energy efficiency and savings.

2.1 Review of RCTs for Residential Energy Efficiency Programs

Randomized controlled trials have become a major component of behavior-based energy efficiency programs and have even experienced growing support from utility and energy industry groups. Authors of a May 2012 study sponsored by State & Local Energy Efficiency Action Network (SEE Action) "recommend using randomized controlled trial (RCT) for behavior-based efficiency programs, which will result in robust, unbiased program savings impact estimates" [32]. The group also recommends using quasi-experimental approaches when RCTs are not feasible. Use of RCTs in behavior-based energy efficiency programs for residential customers has been growing steadily and with measurable results.

2.2 How RCTs Are Used for Residential Energy Efficiency Programs

RCTs have been used to evaluate energy efficiency programs by randomly assigning households in a population into either a treatment group or a control group, followed by a comparison of outcomes yielded by the two groups to generate unbiased estimates of program savings.
The first step in an RCT could include defining a study population. A study population could be screened by specific geographies (i.e., zip codes or service areas), by demographics (i.e., low income, medical needs, elderly), by customer characteristics (i.e., high energy users, dual fuel use, length of customer bill history), or by data requirements (i.e., availability of historical data, census information, or installed smart meters).
Once the households in the study population are randomly assigned into either a treatment or control group, the designed study is executed, and energy use data are collected for all households so analysts can compare the measured energy usage of the treatment households against the control households to estimate energy savings. Data typically come from utility meters, often on a monthly basis.

2.3 Benefits of Using RCTs to Evaluate Residential Energy Efficiency Programs

Multiple benefits observed in using RCTs have helped to drive growing interest in using RCTs to evaluate residential energy efficiency programs. RCTs that randomly assign households to either a treatment or a control group help to eliminate selection bias, leading to unbiased estimates of program energy savings. RCTs can be a key initial step in helping to ensure the validity of program savings estimates for behavior-based energy efficiency programs. The ability to

generate more accurate estimates of the impact of energy efficiency programs offers a risk management benefit that could outweigh potentially higher initial setup costs of RCTs over other evaluation approaches.

Random assignment is a key step to eliminating selection bias in the following way. In contrast to programs that assign households by characteristics such as location, energy use, or willingness to sign up, programs that assign households/participants randomly can limit the effects on study outcomes of pre-existing differences among households. Pre-existing differences could include observable differences, such as energy use or floor area of households, or typically unobservable differences, such as attitudes on energy conservation, number of occupants, expected future energy use, or occupant age. In a random assignment, the RCT control group is assumed to be statistically identical to an RCT treatment group in that there will be no (known) pre-existing differences between the two groups, thereby eliminating selection bias.

The SEE Action study noted another benefit as RCTs eliminate a selection bias from "free riders." Free riders include households that would have saved energy even without an energy efficiency program, such as a household already planning to install R-30 attic insulation when it receives a rebate offer from an efficiency program. RCTs can eliminate this free-rider concern because it is likely that both the treatment and control groups will each contain a similar proportion of free riders owing to the random assignment of the two groups. An RCT design could also capture participant spillover, where participants add energy efficiency measures outside of the initial program. However, an RCT design could underestimate total program-influenced savings because it may not account for non-participant spillover, where a program indirectly influences households in the control group.

2.4 Potential Role of RCTs in Energy Efficiency Programs for the SBSP Community

Broad acceptance of using RCTs to evaluate behavior-based energy efficiency programs for residential utility customers supports the use of RCTs when BBEE programs expand to commercial customers and the SBSP community. However, new BBEE programs designed for the SBSP community must consider additional factors and constraints that may be unique to commercial customers. Important factors to the SBSP community could include analysis of potential upfront costs, tax impacts, and financing requirements of an energy efficiency program. Efforts toward customizing BBEE programs for commercial customers could entail determining new parameters and criteria to select study populations among business segments, re-tooling energy efficiency program options and incentives, and re-designing the structure of RCTs to determine energy savings and business-related factors impacting results. Given the early stages of BBEE programs directed to the SBSP community, initial analysis and guidance to establish best practices could help to drive the growth of BBEE programs in the commercial sector.

3 Use of RCTs or Similar Approaches to Evaluate Energy Efficiency Programs

Lessons learned from early success in using a broad range of RCTs and quasi-experimental approaches to evaluate residential behavior-based energy efficiency programs could be applied to design BBEE programs for the SBSP community. Review of the types of RCT and quasi-experimental approaches could provide the initial framework from which methods could be re-tooled for commercial-based energy efficiency programs.

3.1 Types of RCTs Used to Evaluate Residential Energy Efficiency Programs

Managers of behavior-based energy efficiency programs for residential customers have used several RCT designs to evaluate energy savings from their programs. Types of RCTs include designs where households can either "opt out" or "opt in" to participate in energy efficiency programs. Another type of RCT is a randomized encouragement design where participation in an energy efficiency program is not restricted or withheld to any household in either the treatment or control group. Selection among the RCT designs would likely hinge on the structure of BBEE programs, the scale and scope of the programs, and data available for the trials.

In RCTs with opt-out enrollment options, households determined to be in the study population for the RCT program are randomly assigned. Households in the treatment group receive an invitation or access to participate in the energy savings program, but are allowed to opt out. The control group does not receive access to participate in the program and is not allowed to opt in. Selection bias is limited by retaining opt-out-households in the study. Two estimates could be derived from the data: (1) an intent-to-treat estimate that includes all households in the treatment group (both opt-in and opt-out households); and (2) impacts for households in the treatment group that opted in and received access to participate in the energy efficiency program.

In an RCT with an opt-in recruitment strategy, the energy efficiency program is marketed to all households, and the households decide whether to opt in. The opt-in households are then randomly assigned to the control or treatment groups. Opt-in households are placed in a control group to reduce or eliminate selection bias. Methods to randomly assign opt-in households include: (1) recruit-and-delay (or waitlist) design where households that opt-in are told that the program is oversubscribed and are then randomly assigned to a waitlist; or (2) recruit-and-deny design where households that opt-in are told the program is oversubscribed and some are randomly chosen to participate. Energy use data are then collected for all households represented in data from the treatment and control groups to determine energy savings, and no data are collected from households that did not opt in.

In an RCT with encouragement design (RED), program managers want to allow households to opt in and do not want to deny or delay enrollment in the program. Using this approach is often a good option because the RCT yields an unbiased estimate and it does not exclude anyone from participating in the program. However, this RCT design typically involves a larger sample size

requirement. In an RCT with encouragement design (RED), screened households are randomly assigned to the control or treatment groups. Treatment group households are encouraged to participate in the energy efficiency program through mailers, calls, or other advertisements, while control group households are not encouraged to participate. However, because the program is open to anyone, some of the control group households might have learned about the program and want to opt in. To secure an unbiased estimate of energy savings, energy use data are collected from all households in both groups. In this design, three types of households are identified: (1) never-takers, who will never join the program whether they are encouraged or not; (2) always-takers, who will always join; or (3) compliers, who will join if encouraged. Because randomly assigned treatment and control groups should have the same percentage of never-takers, always-takers, and compliers, the evaluator could exclude the always-takers and evaluate energy savings of the compliers.

3.2 Review of Quasi-experimental Approaches Used in Residential Energy-Efficiency Programs

When randomized controlled trials cannot be conducted, quasi-experimental approaches could be applied to evaluate energy efficiency programs. Quasi-experimental approaches could entail a program evaluation in which a treatment group and a control group are defined, but households are not randomly assigned to these groups. This approach could result in program savings estimates that may be biased. However, in specific cases where RCTs are not feasible, quasi-experimental approaches help to evaluate energy savings from energy efficiency programs.

Following are overviews of several quasi-experimental approaches.

Regression Discontinuity Method – The SEE Action group found that although regression discontinuity typically yields the most unbiased estimate of energy savings among the quasi-experimental approaches, it is also the most complicated, requiring knowledge of econometric models. This method selects by designating households just below a cut-off measure (such as monthly energy consumption below 900 kWh) to be in the control group and selects households above this measure as the treatment group.

Matched Control Group Method – This method could be used when a randomized control group cannot be created. Energy savings estimates could be calculated by selecting a non-random control group of households that are similar to the treatment group. The challenge with this method is that observable characteristics (i.e., level of energy use, zip code, presence of air conditioning) could be matched, whereas the step of matching unobservable characteristics (energy attitudes, propensity to change) would be harder to accomplish. **Propensity score matching** attempts to match households for observable and unobservable characteristics by using observable characteristics to predict the probability of households opting in. The control group would include high-probability households that did not actually opt in. Although this method may be better than the matching method without propensity scores, it still assumes that the observable characteristics used were sufficient to explain unobservable differences.

Variation in Adoption – This method assumes that the timing of those households opting-in is essentially random and thus, the evaluator can assign households to a group of households opting in or those opting in at a later point after exposure to the same marketing programs. However, this assumption could be tested and found not to hold.

Pre-Post Energy Use Method – This quasi-experimental method compares the energy use of the treatment group after enrollment in an energy efficiency program versus the same households' historical energy use. This method of data comparison means that each household in the treatment group is its own non-random control group. A challenge to this method is that other influences (i.e., economic recession) that are independent of the behavior-based efficiency program, might affect energy use over time, leading to biased energy savings estimates.

When considering how to expand energy efficiency programs from residential customers to a broad array of commercial customers and the SBSP community, use of quasi-experimental approaches might be worth considering. The challenges inherent in conducting RCTs to evaluate BBEE programs across a wide range of commercial customers such as retailers or restaurant owners with a variety of available energy data options might warrant a review by evaluators of the quasi-experimental approaches.

3.3 Retooling RCTs or Other Approaches for SBSP Energy Efficiency Programs

Recent growth in the types of RCTs and quasi-experimental approaches to evaluate residential energy efficiency programs should help in efforts to expand BBEE programs to the SBSP community. These RCTs and other approaches could serve as a useful template from which adjustments could be made to accommodate many unique requirements or constraints of commercial customers. Analysis of where these residential RCTs and quasi-experimental approaches were effective or exhibited limitations could prove useful when designing new BBEE programs for the SBSP community. Given the broad range of potential study populations and energy savings data among commercial customers, BBEE programs in the commercial sector could vary widely and require new or re-designed RCT or quasi-experimental approaches.

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4 Summary of Findings of RCT Studies and Identified Gaps

Use of behavior-based energy efficiency programs has been more of a recent phenomenon and many programs are less than five years old. Programs to secure energy efficiency gains among residential utility customers have been increasing steadily and have been driven in part by state mandates or requirements to boost energy efficiency and energy conservation.

4.1 Scope of Utilities and Firms Using RCTs for Residential Energy Efficiency Programs

Multiple utilities and firms have deployed behavior-based studies of residential energy efficiency programs by using RCTs.

Arlington, VA-based firm, OPOWER, has deployed more than 75 behavioral programs and has conducted more than 200 large-scale field tests on residential customers for major utilities, including Pacific Gas & Electric (PG&E) in California, Commonwealth Edison (ComEd) in Illinois, American Electric Power (AEP) in Ohio, and Baltimore Gas and Electric (BGE) in Maryland. OPOWER states that the firm has delivered verified energy savings over time at an average cost effectiveness of US$0.03/kWh saved. The firm estimates that OPOWER programs have resulted in more than 1.5 terawatt-hours of cost-effective energy savings and are projected to deliver 5 terawatt-hours in savings by 2015.

In addition to OPOWER, other firms such as Efficiency 2.0, Tendril, and Enerlyte have served as market partners in providing products or services for efficiency programs. Others include metering companies, power monitoring companies, and technology (home automation) companies. However, these companies might not be delivering comprehensive BBEE programs and might just offer components of a program [33].

Bonneville Power Administration (BPA) has implemented BBEE programs focused on energy savings that resulted from changes in individual or organizational behavior and decision-making [33]. Examples of BPA's BBEE programs include providing residential end-users with information about their energy use, performing comparisons of usage by others, setting goals, and identifying rewards and additional tactics that encourage efficient energy use. In 2011, BPA issued a Funding Opportunity Announcement for innovative BBEE pilots and selected Snohomish County Public Utility District (PUD), Cowlitz Public Utility District, and Clark Public Utilities, whose applications were accepted. BPA is collaborating with these utility customers and their market partners to implement and evaluate innovative BBEE pilot programs that will help build its knowledge of BBEE program strategies and tactics to encourage energy savings. In 2008, **Puget Sound Energy (PSE)** provided Home Energy Reports (HER) to nearly 40,000 households that compared household energy usage to neighboring homes to apply peer pressure to influence behavior and secure energy savings. The PSE program used an RCT with opt-out recruitment to 83,800 households meeting specified criteria (e.g., single family, adequate utility bill data) and then randomly assigned 37,775 households to the treatment group that received the HER. The remaining 44,025 households were assigned to the control group and received no HER.

Hunt Allcott, in his paper "**Social norms and energy conservation**" [20], evaluated programs run by OPOWER that sent HER letters to residential utility customers that compared household energy use to that of similar neighbors. Based on data from randomized natural field experiments at 600,000 treatment and control households across the United States, Allcott estimated that the average program reduced energy consumption by 2.0%, and he found evidence that non-price interventions could change consumer behavior cost effectively. Allcott found that households in the highest decile of pretreatment consumption decreased usage by 6.3%, while consumption by the lowest decile decreased by only 0.3%. Allcott analyzed HER projects started by OPOWER since late 2009 for 14 utilities – six in California and Washington, six in the Midwest, one in the urban Northeast, and one in a suburban area in a mountain state.

Figures 1 and 2 are reprinted from [39]. Figure 1 provides an example of a Home Energy Score for a HER sent to residential power customers, and Figure 2 shows potential recommendations offered by a utility in a HER.

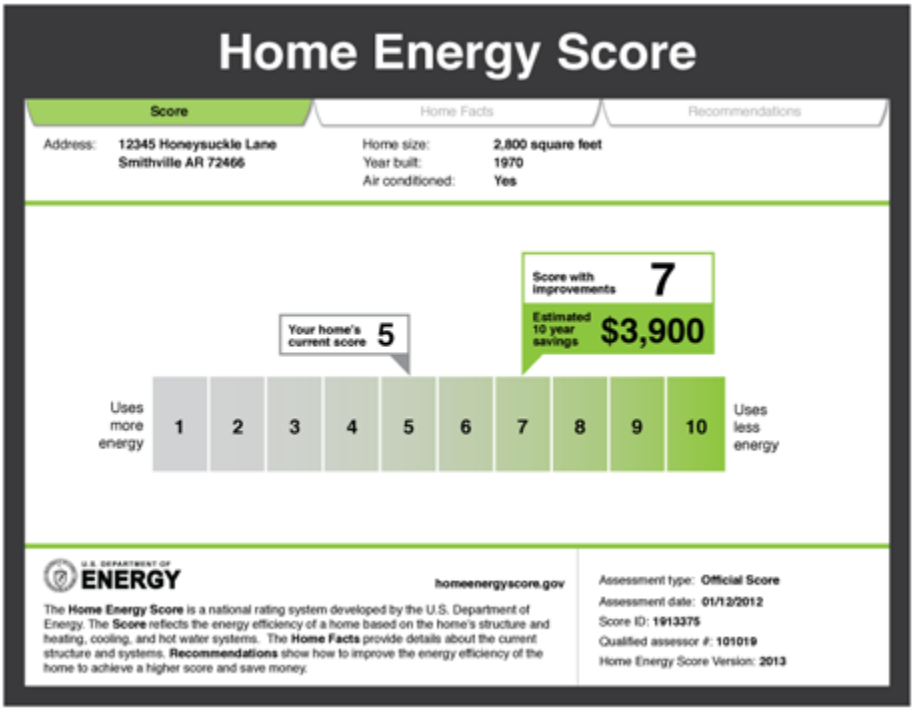
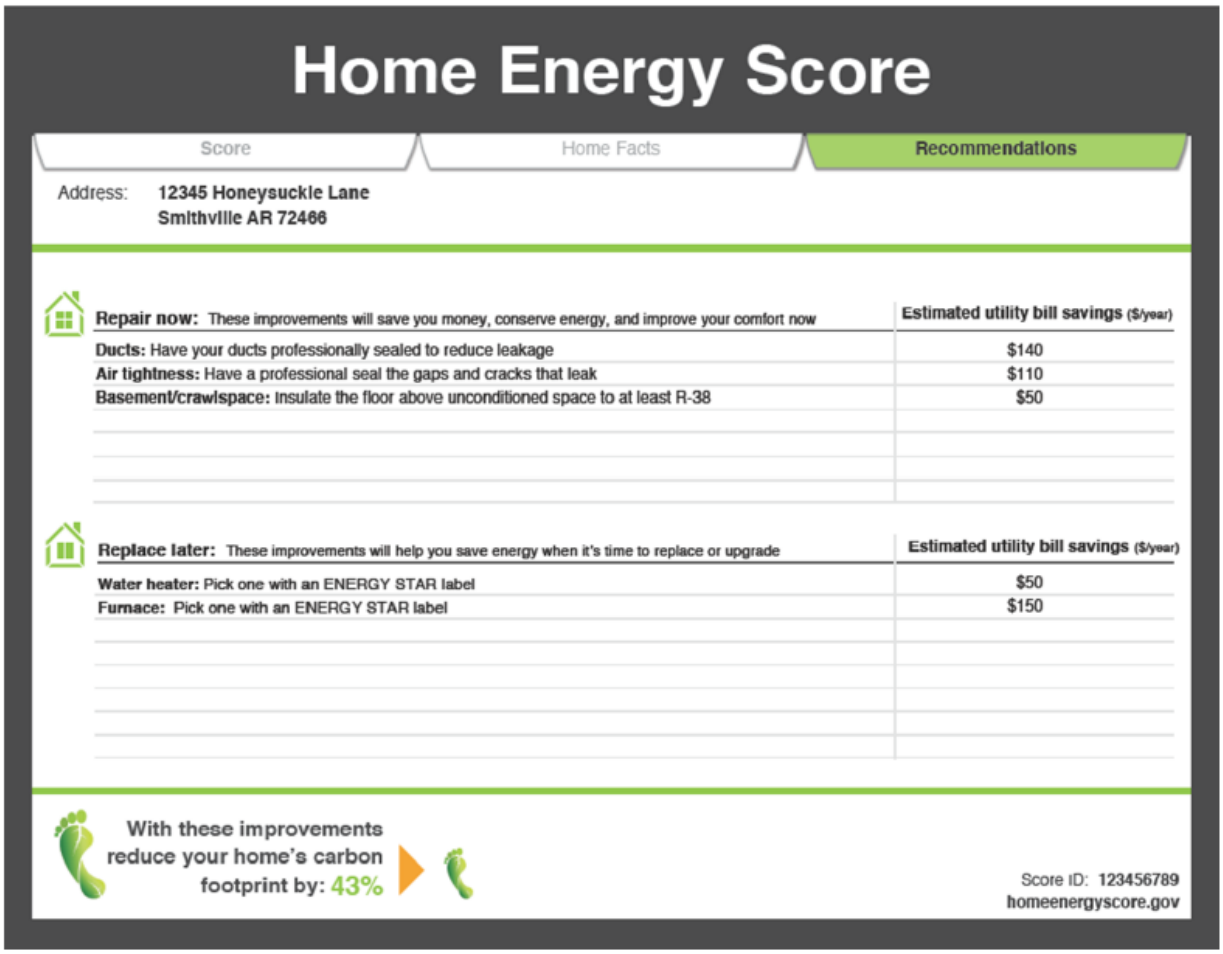


Figure 1: Home Energy Score – Example from DOE [39]



Home Energy Score

Score | Home Facts | Recommendations

Address: 12345 Honeysuckle Lane
Smithville AR 72466

Repair now: These improvements will save you money, conserve energy, and improve your comfort now	Estimated utility bill savings ($/year)
Ducts: Have your ducts professionally sealed to reduce leakage	$140
Air tightness: Have a professional seal the gaps and cracks that leak	$110
Basement/crawlspace: Insulate the floor above unconditioned space to at least R-38	$50

Replace later: These improvements will help you save energy when it's time to replace or upgrade	Estimated utility bill savings ($/year)
Water heater: Pick one with an ENERGY STAR label	$50
Furnace: Pick one with an ENERGY STAR label	$150

With these improvements reduce your home's carbon footprint by: 43%

Score ID: 123456789
homeenergyscore.gov

Figure 2: Home Energy Score: Recommendations – Example from DOE [39]

In 2011, **Bonneville Power Administration** compiled and reviewed several behavioral-based energy efficiency programs in its paper, Residential Behavior Based Energy Efficiency Program Profiles 2011 [33]. BPA noted how studies have shown energy savings of 2–3% from customer feedback. However, adding multiple strategies and tactics, including customer engagement strategies, can achieve greater per-participant energy savings, as shown in Table 1 below. Leading edge BBEE programs are adding more innovative customer engagement strategies, such as using social marketing techniques; performing individual and community goal setting; providing energy saving tips; and sponsoring events, contests, rewards, and recognition. The BPA commented that achieving higher savings levels would require looking outside the energy industry to other sectors with experience using social science research to impact human behavior.

Table 1: Strategies and Tactics That Increase Per-Participant Energy Savings (Source: Bonneville Power Administration 2011)

Residential Behavior Based Energy Efficiency – Programs Summary Matrix							
Program Name	**Yrs Operating**	**Market Partner(s)**	**Usage Feedback Mechanism(s)**	**Customer Engagement**	**# of Participants**	**Claimed Energy Savings**	**Evaluation Methods**
PSE Home Energy Reports	3 yrs (since 2008)	OPower	Paper Reports (mailed monthly or quarterly)	Usage comparisons (norms), action steps (tips), website	Opt-out, 40,000 (2010)	2.0% avg. elect. per part.	Billing analyses, control group
SCL Home Energy Reports	2 yrs (since 2009)	OPower	Paper Reports (mailed every 2 months)	Usage comparisons (norms), web-based option now available	Opt-out, 50,000 (2011)	Expect 2-3% per part.	Billing (kWh) analysis, control group
Snohomish PUD Energy Challenge	2+ yrs (since 2009)	None	Paper Reports (mailed every 6 months)	10% challenge (pledge) Usage comparisons (norms), tips, rewards	Opt-in, 3,500 (June 2011)	Avg. 1.5% per part. (2010)	Billing (kWh) analysis, control group
ETO Home Energy Reports	1 year (2011)	OPower	Paper Reports (mailed every 2 months)	Usage comparisons (norms), action steps (tips), website	Opt-out, 60,000 (2011)	2.0% avg. savings per part.	Billing analysis, control group, surveys
B.C. Hydro Team Power Smart	3 yrs (since 2008)	Various	Tool box (on-line) includes usage feedback	Tool box , goal setting, events, contests, rewards	Opt-in, 75-80,000 active	10% goal met by 20% , 4-5% others (2010)	Billing (kWh) analysis, surveys
Illinois CUB Energy Saver	1+ yrs (since 2010)	Efficiency 2.0 Recyclebank	Email & print reports, website	Website info/tools , social networks, goals, contests, rewards	Opt-in (on-line); 11,682 (yr. 1)	5.5-6% per on-line part.	Billing (kWh) analysis, control group
WMECO Mass Saves	1+yrs (since 2010)	Efficiency 2.0 Recyclebank	Email & print reports, website	Website info/tools, community contests, goals, rewards	Opt-in (on-line); 7,200 currently	3-6% per on-line part.	Billing (kWh) analysis, control group
SMUD Home Electricity Reports	3 yrs (since 2008)	OPower	Monthly Paper Reports (some quarterly)	Usage comparisons, web tools (2010)	Opt-out, 38,500 (2011)	2.89% per part. (mo. reports)	Billing (kWh) analyses, control group
Payson City Power EE Reports	1 yr. (since 2010)	Enerlyte	Utility bills, website, phone app.	Usage comparisons, website info/tools, goals, contests	Approx. 5,000	2.4% per part. (receiving bills)	Billing (kWh) analysis, control group
CLC Energy Monitoring Pilot	2 yrs (since 2009)	Tendril	Web-based dashboard, In-home displays	Usage comparisons, social networking, 10% goal, EE tips	Opt-in, 350 part.	9.3% per part.	Billing (kWh) analysis, control groups
Source: Residential Behavior Based Energy Efficiency Program Profiles 2011, Prepared by Skip Schick and Summer Goodwin, Bonneville Power Administration, December 2011							

4.2 Lessons Learned and Advice from BBEE Program Managers

The manager of **Western Massachusetts Electric Company's (WMECO's) Mass Saves Program** stressed the importance of "on the ground" community involvement, noting how communities that join the community challenge are reaching their 3% savings goal. WMECO uses "surround sound" marketing, with emphasis on the rewards component to achieve greater customer engagement.

A program manager for **B.C. Hydro's Power Smart** program noted that regular communications and interaction was critical, with research indicating strong correlation between engagement and savings. BC Hydro focused on promoting participants at the enjoyment (challenge) level, where members were more engaged and the bulk of the energy savings occurred. One important principle was to understand that customers may not necessarily be interested in energy savings, and thus, it is important to meet the customers at their levels of interest and motivation.

Sacramento Municipal Utility District (SMUD) found that normative messaging was more effective with some customers than others, prompting SMUD to tailor its messaging for various segments. SMUD found that its voluntary "pledge to save" goal participants achieved energy savings that were about three times higher than average savings.

Snohomish PUD's Energy Challenge program is structured around getting customers to commit to a 10% energy reduction goal, with 10% of those pledging having already met their goals.

Cape Light Compact's program manager found that one important factor was people informing each other about energy saving actions to take. Some program participants even self-diagnosed their increases in energy usage, uncovering causes such as the heat being left on, refrigerator cycling issues, or other problems.

Some utilities added an online participation component. **Illinois' Citizens Utility Board Energy Saver** program provides customers with both print and email reports, as well as access to a program Web site. The print reports are sent to the entire target population whereas customers who "opt in" receive the email reports and access to the program Web site. Ongoing communications, rewards, community contests, and customer engagement are geared toward encouraging more people to actively participate online.

The BPA also noted that economies of scale must be considered, since much of the cost of operating these programs is for initial set up requirements. These costs could include aligning the utility billing system/data, characterizing target markets, establishing baseline energy consumption, creating normative groups for comparison purposes, creating marketing messages and customer outreach strategies, customizing Web site and basic tips, and establishing a control group and assessment methodology (see page 8 of [33], the BPA's 2011 Profiles report). These costs are largely fixed regardless of whether the target population is 10,000 or 200,000 customers. This fact makes the size of the target population an important consideration in terms of securing economies of scale and lowering per-participant costs.

4.3 A U.K.-based RCT Study to Evaluate Fuel Poverty Intervention

Another RCT study, conducted in northeast England in the United Kingdom, was evaluating a pragmatic randomized controlled trial of fuel poverty intervention in the region over a four-year period starting in 2000/2001. In the paper, **A Randomised Controlled Trial of an Energy Efficiency Intervention for Families Living in Fuel Poverty** [34], Bob Heyman and his team discuss how the trial group received an energy efficiency intervention package in year three and

the control group in year four. A comparison group of households that were *not* living at fuel poverty was also surveyed over the four-year period. The design of the study assessed the impact of energy efficiency measures in relation to a wide range of potential benefits including fuel expenditure, room temperature, satisfaction with heating, mental and physical health, and use of health services. The findings support continuing fuel intervention programs, which were found to generate modest, but long-lasting fuel efficiency gains.

4.4 Behavior-based Energy Efficiency Programs for Commercial Customers and Their Potential Receptivity to Implementing RCTs

While use of BBEE programs has spread on the residential side, their use in commercial applications could be broadened. BBEE programs using RCTs to evaluate results could be applied to a range of heterogeneous types of commercial customers. Utilities and power industry groups have broadened the reach of some of their behavior-based energy efficiency programs beyond residential customers to commercial customers. Lessons learned may be used to guide the development of energy efficiency programs to the SBSP community.

Hunt Allcott and Michael Greenstone, in their July 2012 paper, **Is There an Energy Efficiency Gap?** [35], highlighted the opportunity and need for "policy-relevant research that utilizes randomized controlled trials and quasi-experimental techniques to estimate the returns to energy efficiency investments and the welfare effects of energy efficiency programs" (p. 1). Allcott and Greenstone note that evidence of energy costs savings from energy efficiency comes from engineering analyses or observational studies that could be subject to well-known biases. Allcott and Greenstone support using randomized controlled trials and quasi-experimental techniques to estimate impacts of energy efficiency programs on heterogeneous consumer types and to address challenges posed by unobserved costs and benefits. When commenting about different approaches to evaluating the impact of imperfect information that could cause an energy efficiency gap, Allcott and Greenstone noted that they were not aware of any large-scale randomized evaluations of energy efficiency information disclosure (p. 22). Thus, the data collected through the RCT process could assist in supplementing commercial firms' reliance on engineering analyses and observational studies.

4.5 Examples of Behavior-based Energy Efficiency Programs for Commercial Customers and Other Nonresidential Customers

A Stanford University group led by Marilyn Cornelius et al. (2012) conducted a school-based RCT to boost energy efficiency behaviors among students. In their paper, **Increasing energy- and greenhouse gas-saving behaviors among adolescents: a school-based randomized controlled trial** [36], the group discussed how a randomized controlled trial was used to evaluate an intervention to promote behaviors that would save energy and reduce greenhouse gas (GHG) emissions. The focus was on changing behaviors rather than on increasing knowledge, awareness, and attitudes. In the RCT, public high school students (N=165) in a required course were randomly selected by the teacher to receive their usual coursework or receive a five-week,

five-lesson behavior change curriculum promoting changes to reduce home electricity, transportation, and food-related energy use and GHG emissions. Students reported their energy- and GHG-saving behaviors at baseline and six weeks later. Results indicated a statistically significant increase in energy- and GCG-saving behaviors among students who were selected for the special curriculum over the control group, indicating that theory-driven, school-based classroom intervention could increase behaviors among adolescents.

Bonneville Power Administration's behavioral-based energy efficiency programs included assisting commercial end users in benchmarking their buildings' rates of energy use and improving the operating performance through building or equipment tune-ups and changes in operating and maintenance routines.

Snohomish PUD Energy Challenge was open to residential customers and small commercial customers. It asked participants to commit to using 10% less electricity in exchange for an entry into quarterly drawings for prizes. The program provided recipients with their current and historical levels of energy use, energy-saving tips, and prize drawings for audits and other assistance. Preliminary results showed savings by participants. Snohomish PUD offers the Energy Challenge to its commercial customers as well, with quarterly reporting and a 1- to 3-year pledge period. The response to the program has been extremely positive, with a number of businesses already exceeding goals (up to 34% savings) and total savings of more than double the savings that had been seen in the residential sector to date. In future RCTs, the PUD expects to recruit additional residential and commercial customers to the challenge. It is also considering whether to bring in outside support to help with further program developments and operations. **Commonwealth Edison, Seattle City Light,** and **Snohomish PUD** have used segmentation information to target their BBEE programs to specific audiences.

4.6 Growing Need for Partners for Commercial and Government Sector BBEE Programs

Once BBEE programs have been installed for residential customers, further expansion of these kinds of programs to commercial customers or the SBSP community could be realized. Lessons learned from the more widely implemented residential programs might be applicable to commercial customers and small businesses. Interest in behavior-based energy efficiency programs is gaining momentum among commercial customers. In September and October 2011, the DOE's Technical Assistance Program (TAP) hosted small group peer exchange calls resulting in a listing of participants who were interested in energy-related behaviors and decision-making issues to lead to potential policies or programs [37,38]. This included a broad range of behavior-based energy efficiency interests from learning how to encourage staff to practice more efficient IT practices, manage office equipment energy use, install energy conservation measures, implement commercial energy retrofit programs, and other measures to engage the small business community. This illustrates the potential growth in BBEE programs for the commercial or governmental sector and the need to develop best practices and templates for BBEE programs and related RCT evaluation methods for these sectors.

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5 Recommendations on Further Development of RCT Pilot Projects for SBSPs

Our review of how the use of RCTs to evaluate consumer purchasing and decision-making behaviors reveals how RCTs have become effective tools in determining best practices and lessons learned. Initial success with residential behavior-based energy efficiency programs among selected U.S. utilities and energy partners has sparked an interest in broadening these programs across the United States and into the commercial sector. While small- and medium-sized businesses may share some of the purchasing behaviors with individual consumers, important differences must be considered, including the need to consider firm size and economies of scale to cover upfront costs, the impact of regulatory constraints, or the limitations of capital equipment. Growth in behavior-based residential energy efficiency programs has sparked the development of several types of BBEE options and RCT evaluating tools.

Broad acceptance of using RCTs to evaluate BBEE programs for residential utility customers may support the use of RCTs when BBEE programs expand to commercial customers and the SBSP community. Lessons learned from residential BBEE programs could be applied when designing BBEE programs and RCTs for the commercial sector. However, these programs would need to be redesigned to meet requirements and constraints that may be unique to commercial customers.

To accomplish this, we recommend that DOE consider the following as potential goals and areas of future focus:

- Conduct a detailed study to determine the potential for RCT pilot programs to construct effective BBEE programs for commercial customers and the SBSP community. Several types of RCTs were successfully used to evaluate residential energy efficiency programs and could be adjusted to promote successful energy efficiency programs for the SBSP community. Further analysis could determine how to apply opt-in, opt-out, or RED random controlled trial methods to small businesses at multiple sites. Analysis could also determine how quasi-experimental programs could be adjusted to evaluate small business energy efficiency programs.

- Identify and analyze new factors and constraints that are impacting decision making for commercial customers that warrant changes to the structure and implementation of BBEE programs and use of RCT evaluation tools for the SBSP community. Efforts to customize BBEE programs for commercial customers could entail determining new parameters and criteria to select study populations among business segments, re-tooling energy efficiency program options and incentives, and re-designing the structure of RCTs to determine energy savings and business-related factors that could impact results. Further study would be needed to determine the selection criteria for study populations among a broad range of commercial businesses that are facing different operating or regulatory constraints.

- Design and conduct RCT pilot projects to evaluate the effectiveness of prototype BBEE programs that are customized for the SBSP community. Lessons learned from the early success of a broad range of RCTs and quasi-experimental approaches to evaluate

residential behavior-based energy efficiency programs could be applied to designing BBEE programs for the SBSP community. Review of the types of RCT and quasi-experimental approaches could provide the initial framework from which methods could be re-tooled for commercial-based energy efficiency programs.

- Analyze results of RCT pilot projects to determine lessons learned and best practices to guide in the creation of templates or tools to facilitate development of BBEE programs for commercial customers. Results for RCT pilot projects for commercial customers could be used to form suggested BBEE options and targeted market segments. This could help to determine what type of commercial customers would be best suited to respond to different BBEE incentives or program options, and which RCTs would be best suited to evaluate the results from BBEE programs.

- Develop BBEE and RCT teaching or guidance programs for commercial customers via training vehicles or web-based resource centers. DOE's TAP hosted small group peer exchange calls in the Fall of 2011, revealing a wide range of commercial and governmental sector interest in BBEE interests — from learning how to encourage staff to conserve energy to implementing commercial retrofit programs — to measures to engage the small business community. This illustrates the potential growth in BBEE programs for the commercial or governmental sector and the need to develop the best practices and templates for BBEE programs and the related RCT evaluation methods for these sectors.

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Appendix A – DOE TAP Energy Efficiency Behavior Change Peer Exchange

DOE TAP Commercial and Government Sector Energy Efficiency Behavior Change Peer Exchange [37]

The purpose of this document is to share information provided by peer exchange participants to identify community interests for further peer exchange. If you would like to request a Peer Match with one of the communities listed below, please do so by sending an email to solutioncenter@ee.doe.gov with the following subject line: **"DOE TAP Peer Match Request – Behavior Change."**

Local/Participant Title	Subject	Background	We are interested in…
City of Asheville, NC Sustainability Outreach Specialist	Implementing anti-idling policy	City of Asheville is developing an anti-idling policy for staff that will require behavior modification. This policy will apply mainly to our field staff who drive Asheville fleet vehicles as well as to those who participate in the car share program.	• Behavior change programs • Implementing policy-based behavior change projects • Sharing my experience and mentoring others
City of Austin, TX Climate Protection Program Program Coordinator	Using real time monitoring and sub-metering to increase awareness of energy reductions	City of Austin would like to learn more about how other communities are working with their internal staff to practice more efficient IT practices and manage energy use from personal office equipment. The city is also engaging internal staff using real time energy monitoring and would like to discuss how other communities may be using metering and dashboards to increase awareness and drive behavior changes.	• Government sector behavior change programs

Local/Participant Title	Subject	Background	We are interested in…
Carver, MN Energy and Household Hazardous Waste Coordinator	Using social media and behavior feedback to motivate energy efficiency behaviors	Carver County plans to influence employee behavior and use this experience to impact constituent behavior through four projects: promote double sided printing, turn off equipment when not in use, use appropriate lighting, and increase organics composting and recycling. The county would like examples of social media use elsewhere, including instructional videos, advertising about what your "neighbors" are doing, and public recognition campaigns.	• Residential sector behavior change programs • Government sector behavior change programs • Implementing policy-based behavior change projects • Sharing my experience and mentoring others
Cary, NC Sustainability Manager	Measuring behavior-change efforts	Cary is interested in ways to measure the impact of behavior-based initiatives, and more generally, how to track progress towards reduction goals.	• Government sector behavior change programs
City of Colorado Springs, CO Energy Efficiency Services Administrator	Portfolio Manager Energy Challenge and a "Take the Stairs Campaign"	The City of Colorado Springs is planning to start an energy challenge between two similar facilities using Portfolio Manager Energy Usage Intensity metrics. It also wants to start a "take the stairs" campaign in our larger buildings.	• Behavior change programs • Implementing policy-based behavior change projects

Local/Participant Title	Subject	Background	We are interested in…
Cuyahoga County, OH Program Manager	Training Manual for Energy Conservation Measures	The Cuyahoga County Planning Commission is working with 50 municipalities in the County to audit their municipal buildings and install Energy Conservation Measures (ECMs). The next step is to develop a Training Program for municipal maintenance staff and a "Behavioral Handbook" for municipal staff. The county is interested in what other communities have done or will be doing to train and orient staff on energy efficiency.	• Behavior change programs
Jefferson County, WA Resource Conservation Manager	Interior Climate Control	The County Resource Conservation Office works across County and City agencies to implement energy, water, and solid waste reduction plans. This office is interested in proven techniques to motivate occupants to participate in resource savings and to mitigate conflict with reducing temperature set points in offices.	• Implementing policy-based behavior change projects

Local/Participant Title	Subject	Background	We are interested in…
Lebanon, MO Grant Projects Manager	Implement commercial energy efficiency program	Lebanon, MO has a commercial energy retrofit program called the Downtown Green Street Project – the city is funding audits and retrofits for local business owners and would like more information on ways to educate these organizations on how they can increase the savings from retrofits through specific behavior modifications.	• Commercial Behavior change programs
City of Livermore, CA *Senior Planner*	Engaging small business in energy efficiency	Livermore is interested in learning about some innovative ways of engaging the small business community, in light of perceived, and real costs. How do other communities connect with small- and medium-sized businesses?	• Behavior change programs
Division of Energy Missouri Department of Natural Resources Research Analyst	Communicating the value of energy efficiency to specific commercial/government sectors	Internal government staff, small businesses, and large commercial organizations all have different role players and reasons for adopting energy efficiency measures. How should program administrators communicate the value proposition of energy efficiency so that it resonates with specific audiences and categories of actors?	• Commercial sector behavior change programs • Government sector behavior change programs

Local/Participant Title	Subject	Background	We are interested in…
Omaha/Lincoln, Nebraska reEnergize Program Coordinator	Contractor training and outreach/education with households and local businesses	The reEnergize Program in Omaha/Lincoln, is working to build a robust market for energy evaluation and upgrades in homes and businesses. Behavior change begins with building up the number and capability of contractors in the area. How are others increasing awareness of energy opportunities through behavior change among households and small business owners?	• Residential sector behavior change programs • Commercial sector behavior change programs
Palm Beach County, FL Energy Manager	HVAC management strategies for building operators	Palm Beach County is working closely with building management staff on ways to manage building energy usage through HVAC controls and other management strategies. The county is looking for good resources on ways to better engage with our building operators.	• Behavior change programs • Implementing policy-based behavior change projects
Rancho Cucamonga, CA Energy Efficiency Coordinator	Energy education and outreach strategies for schools and local businesses	The City of Rancho Cucamonga is interested in learning how to engage with businesses and schools to increase energy efficiency in the community.	• Behavior change programs • Implementing policy-based behavior change projects

Local/Participant Title	Subject	Background	We are interested in…
San Jose, CA Energy Officer	Developing a temperature set point policy for municipal buildings	The City of San Jose Municipal Energy Group is interested in learning about and implementing behavior change projects with our city staff to maximize energy efficiency in our municipal buildings. The City has a Green Vision Goal to reduce energy usage by 50% within a 15 year time frame. In addition, we are currently drafting a temperature set point policy for municipal buildings.	• Behavior change programs • Implementing policy-based behavior change projects • Sharing my experience and mentoring others
Will County, IL Recycling and Energy Program Specialist	Using energy usage data to educate residents and businesses about energy efficiency opportunities	Will County developed a website to educate residents and businesses on strategies to reduce energy usage through conservation and efficiency. Will County also engages with businesses through half-day energy seminars, school student education programs, and residential recycling programs. The county is interested in ways to use internal energy usage data to better engage employees and lead by example – success will be shared using the county website.	• Residential sector behavior change project • Commercial sector behavior change program • Government sector behavior change programs • Implementing policy-based behavior change projects • Sharing my experience and mentoring others

DOE TAP Residential Sector Energy Efficiency Behavior Change Peer Exchange [38]

The purpose of this document is to share information provided by peer exchange participants to identify community interests for further peer exchange. If you would like to request a Peer Match with one of the communities listed below, please do so by sending an email to solutioncenter@ee.doe.gov with the following subject line: **"DOE TAP Peer Match Request – Behavior Change."**

Local/Participant Title	Topic	Background	We are interested in…
City of Asheville, NC Sustainability Outreach Specialist	Residential recycling: shifting program from pre-sort to single stream	The City of Asheville will be transitioning from a pre-sort residential curbside recycling program to a single stream program, accepting new materials, and is interested in associated behavior change issues.	• Behavior change programs • Implementing policy-based behavior change projects • Sharing my experience and mentoring others
Austin, TX Marketing Manager	Measuring and increasing energy-related behavior change at the household level	Austin is interested in finding ways to measure and increase changes in household behaviors that accompany energy efficiency upgrades.	• Behavior change programs • Residential sector behavior change programs • Commercial sector behavior change programs • Implementing policy-based behavior change projects

Local/Participant Title	Topic	Background	We are interested in…
City of Boston, MA Chief of Staff, Office of Environmental and Energy Services	Retrofits for middle income residents	Boston is implementing a program to provide free retrofits for middle income households and is interested in learning more about workshops and strategies for motivating groups.	• Behavior change programs • Residential sector behavior change programs
Boulder County, CO Energy Efficiency Specialist	Motivating groups that may be interested in energy efficiency, but are very busy	Boulder County is beginning to implement a community-based behavior change program that will engage trusted groups (homeowner associations, churches, rotary clubs, etc.) to encourage friendly competition toward energy upgrades/savings goals.	• Behavior change programs • Residential sector behavior change programs
Carver, MN Energy and Household Hazardous Waste Coordinator	Neighborhood feedback and recognition program	Carver plans to use social media, including instructional videos, photos, and advertising to increase public recognition via the Web and mailings and is interested in learning what others are doing in these areas.	• Residential sector behavior change programs • Government sector behavior change programs • Implementing policy-based behavior change projects • Sharing my experience and mentoring others

Local/Participant Title	Topic	Background	We are interested in…
Central New York Regional Planning and Development Board (NYSERDA Partner) *Senior Planner*	Community group program based on UK EcoTeam model	The Board is working with NYSERDA to implement a residential behavior change pilot program and plans to roll out more broadly. Based on the EcoTeam program, 5-8 households meet and work through a curriculum starting with simple energy conservation through a completion of a comprehensive home energy assessment.	• Residential sector behavior change programs
Missouri Department of Natural Resources, Division of Energy Research Analyst	Strategies for overcoming data confidentiality issues	Missouri DNR is interested in learning about different types of behavior change programs and is particularly interested in exploring the dimensions of data exchange and confidentiality. Also, strategies for working with utilities to overcome data-related barriers.	• Commercial sector behavior change programs • Government sector behavior change programs
Rancho Cucamonga, CA *Energy Efficiency* Coordinator	Residential workshop effectiveness	Rancho Cucamonga is interested in learning about residential energy efficiency programs that can be applied here, especially in determining the effectiveness of workshops for residents hosted by the city.	• Behavior change programs • Implementing policy-based behavior change projects

Local/Participant Title	Topic	Background	We are interested in…
Washoe Tribe of Nevada & California (Carson Colony, Dresslerville Colony, Woodfords Community, Stewart Community, & Washoe Ranches) Environmental Specialist II	Retrofitting on a shoe string budget	The Washoe Tribe is interested in learning about behavior change programs, methods for executing the right change, and hearing about other experiences.	• Behavior change programs • Commercial sector behavior change programs • Implementing policy-based behavior change projects

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